

## CLAIMS

What is claimed is:

1. An apparatus for characterizing a void in a first scan target associated  
5 with a sample, the sample having a first surface and a second surface, the apparatus comprising:

an x-ray emission inducer configured to scan a first scan target, the x-ray  
emission inducer causing the first scan target to emit x-rays from the first surface;

an x-ray emission detection system configured to obtain a measurement of the  
10 x-rays emitted from the first surface of the sample, wherein the x-ray measurement  
is compared to a control measurement to characterize a void in the first scan target.

2. The apparatus of claim 1, further comprising a stage configured to  
secure the sample, wherein the stage is configured to position the sample relative to the  
x-ray emission inducer.

3. The apparatus of claim 2, wherein positioning the sample comprises  
15 rotating the sample.

4. The apparatus of claim 2, wherein the first scan target comprises a via.

5. The apparatus of claim 4, wherein the sample is a wafer comprising a  
plurality of integrated circuits.

6. The apparatus of claim 1, wherein the x-ray emission detection system is  
20 configured to detect x-rays with a first emission energy corresponding to a first  
material.

7. The apparatus of claim 6, wherein the first material comprises Cu.

8. The apparatus of claim 7, wherein the x-ray emission detection system is  
25 further configured to detect x-rays with a second emission energy corresponding to a  
second material.

9. The apparatus of claim 8, wherein the second material comprises Ta.

10. The apparatus of claim 9, wherein the control measurement is obtained  
by scanning an adjacent scan target.

11. A system for characterizing voids associated with a sample, the sample  
30 having a first surface and a second surface, the system comprising:  
memory;

a processor coupled with memory, the processor configured to identify a first measurement of induced x-ray emissions characteristic of a first material at a first scan target, identify a control measurement, and provide the first measurement and the control measurement for comparison to thereby obtain information for characterizing a void associated with the first scan target in the sample.

12. The system of claim 11, wherein the first material has low resistivity.

13. The system of claim 12, wherein the first material is copper.

14. The system of claim 11, wherein the sample is a wafer comprising a plurality of integrated circuits.

15. The system of claim 11, further comprising identifying a second measurement of x-ray emissions characteristic of a second material.

16. The system of claim 11, wherein the second material is a barrier material.

17. The system of claim 16, wherein the second material is Ta.

18. The system of claim 11, wherein characterizing voids associated with the sample comprises determining the size and location of a void.

19. The system of claim 11, wherein the control measurement is obtained by scanning an adjacent scan target.

20. The system of claim 19, wherein the scan target is a via.

21. The system of claim 20, wherein the adjacent scan target is an adjacent via.

22. The system of claim 21, wherein the control measurement is obtained by scanning adjacent vias in the +x, -x, +y, and -y positions.

23. The system of claim 22, wherein the control measurement is obtained by scanning adjacent vias in the +2x, -2x, +2y, and -2y positions.

24. A method for characterizing a void in a sample, the method comprising: identifying a first measurement of induced x-ray emissions characteristic of a first material at a first scan target.

identifying a control measurement;

providing the first measurement and the control measurement for comparison to thereby obtain information for characterizing a void associated with the first scan target in the sample.

25. The method of claim 24, wherein the first material has low resistivity.

26. The method of claim 25, wherein the first material is copper.
27. The method of claim 24, wherein the sample is a wafer comprising a plurality of integrated circuits.
28. The method of claim 24, further comprising identifying a second measurement of x-ray emissions characteristic of a second material.
29. The method of claim 24, wherein the second material is a barrier material.
30. The method of claim 29, wherein the second material is Ta.
31. The method of claim 24, wherein characterizing voids associated with the sample comprises determining the size and location of a void.
32. The method of claim 24, wherein the control measurement is obtained by scanning an adjacent scan target.
33. The method of claim 32, wherein the scan target is a via.
34. The method of claim 33, wherein the adjacent scan target is an adjacent via.
35. The method of claim 34, wherein the control measurement is obtained by scanning adjacent vias in the +x, -x, +y, and -y positions.
36. The method of claim 35, wherein the control measurement is obtained by scanning adjacent vias in the +2x, -2x, +2y, and -2y positions.
37. An apparatus for characterizing a void in a sample, the apparatus comprising:
- means for identifying a first measurement of induced x-ray emissions characteristic of a first material at a first scan target.
  - means for identifying a control measurement;
  - means for providing the first measurement and the control measurement for comparison to thereby obtain information for characterizing a void associated with the first scan target in the sample.
38. The apparatus of claim 37, wherein the control measurement is obtained by scanning an adjacent scan target.
39. The apparatus of claim 38, wherein the adjacent scan target is an adjacent via.
40. The apparatus of claim 39, wherein the control measurement is obtained by scanning adjacent vias in the +x, -x, +y, and -y positions.

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Wavelength, Å	Intensity	Wavelength, Å	Intensity
344.7	100	410.1	100
348.8	100	417.8	100
354.4	100	422.7	100
365.0	100	426.8	100
377.0	100	430.0	100
383.5	100	434.0	100
393.4	100	438.0	100
404.4	100	442.0	100
410.1	100	446.0	100
417.8	100	450.0	100
422.7	100	454.0	100
426.8	100	458.0	100
430.0	100	462.0	100
434.0	100	466.0	100
438.0	100	470.0	100
442.0	100	474.0	100
446.0	100	478.0	100
450.0	100	482.0	100
454.0	100	486.0	100
458.0	100	490.0	100
462.0	100	494.0	100
466.0	100	498.0	100
470.0	100	502.0	100
474.0	100	506.0	100
478.0	100	510.0	100
482.0	100	514.0	100
486.0	100	518.0	100
490.0	100	522.0	100
494.0	100	526.0	100
498.0	100	530.0	100
502.0	100	534.0	100
506.0	100	538.0	100
510.0	100	542.0	100
514.0	100	546.0	100
518.0	100	550.0	100
522.0	100	554.0	100
526.0	100	558.0	100
530.0	100	562.0	100
534.0	100	566.0	100
538.0	100	570.0	100
542.0	100	574.0	100
546.0	100	578.0	100
550.0	100	582.0	100
554.0	100	586.0	100
558.0	100	590.0	100
562.0	100	594.0	100
566.0	100	598.0	100
570.0	100	602.0	100
574.0	100	606.0	100
578.0	100	610.0	100
582.0	100	614.0	100
586.0	100	618.0	100
590.0	100	622.0	100
594.0	100	626.0	100
598.0	100	630.0	100
602.0	100	634.0	100
606.0	100	638.0	100
610.0	100	642.0	100
614.0	100	646.0	100
618.0	100	650.0	100
622.0	100	654.0	100
626.0	100	658.0	100
630.0	100	662.0	100
634.0	100	666.0	100
638.0	100	670.0	100
642.0	100	674.0	100
646.0	100	678.0	100
650.0	100	682.0	100
654.0	100	686.0	100
658.0	100	690.0	100
662.0	100	694.0	100
666.0	100	698.0	100
670.0	100	702.0	100
674.0	100	706.0	100
678.0	100	710.0	100
682.0	100	714.0	100
686.0	100	718.0	100
690.0	100	722.0	100
694.0	100	726.0	100
698.0	100	730.0	100
702.0	100	734.0	100
706.0	100	738.0	100
710.0	100	742.0	100
714.0	100	746.0	100
718.0	100	750.0	100
722.0	100	754.0	100